MIDWAY'S

Galaxian

TROUBLE SHOOTING LOGIC BOARD
PART I



PHONE
(312) 451-1360

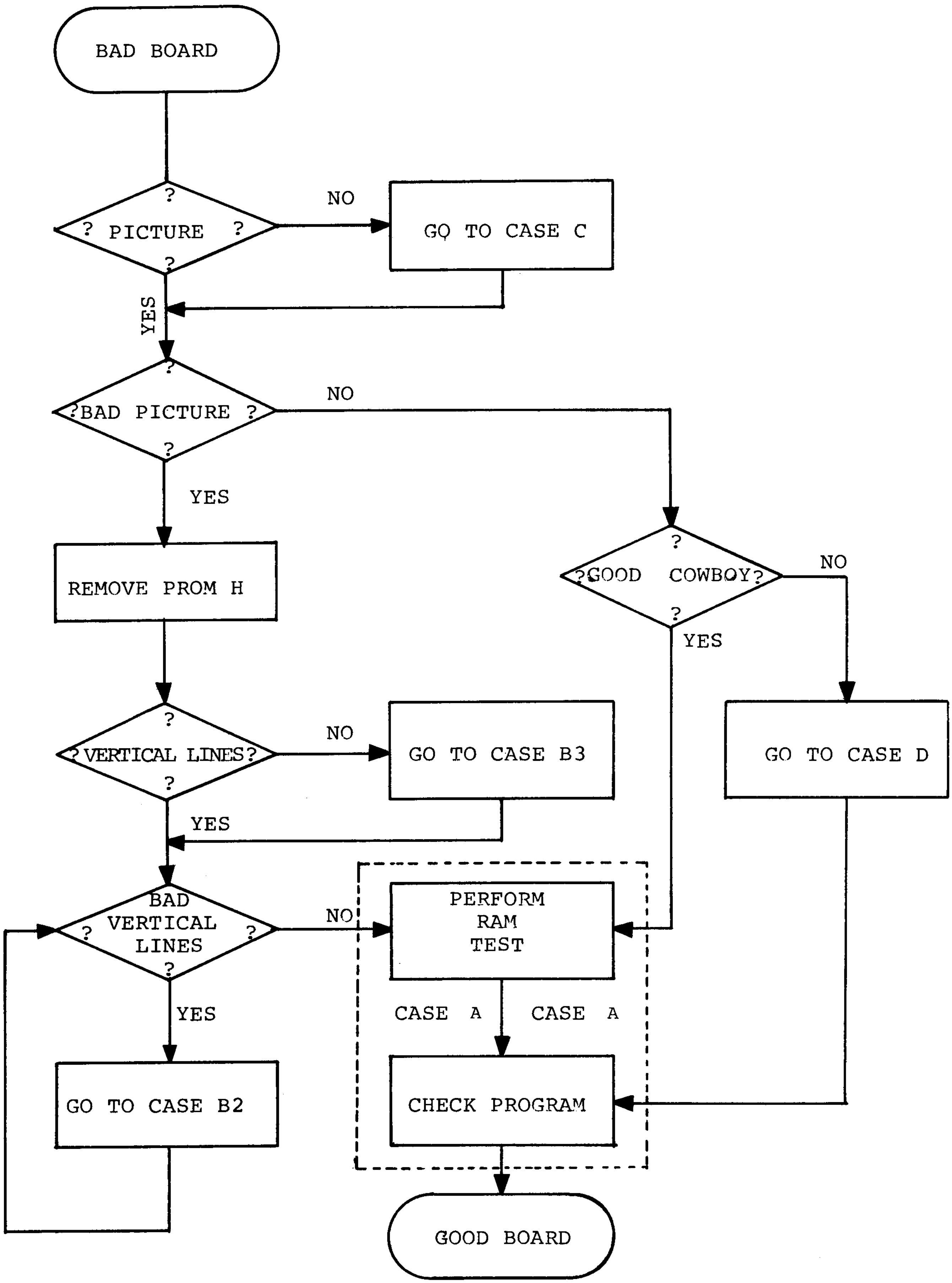
MIDWAY MFG. CO.
A BALLY COMPANY
10750 WEST GRAND AVENUE
FRANKLIN PARK, ILLINOIS 60131
U.S.A.

PHONE
TOLL FREE
800-323-7182

FORM 00216–8008

FLOW CHART OF TROUBLESHOOTING

PROCEDURE



Galaxian

GALAXIAN, Midway's new space wars video game, features a full color monitor and is available in a 1 or 2 player upright or cocktail table model.

The player, controlling the Galaxian defenders of the Earth, must destroy a convoy of aliens that are equally determined to annihilate him by firing missiles. The defender must protect himself without the aid of barricades. He must shoot down not only alien army regulars, but also out-maneuver and destroy enemy fighter escort ships that peel off from the main body of the alien squadron at random.

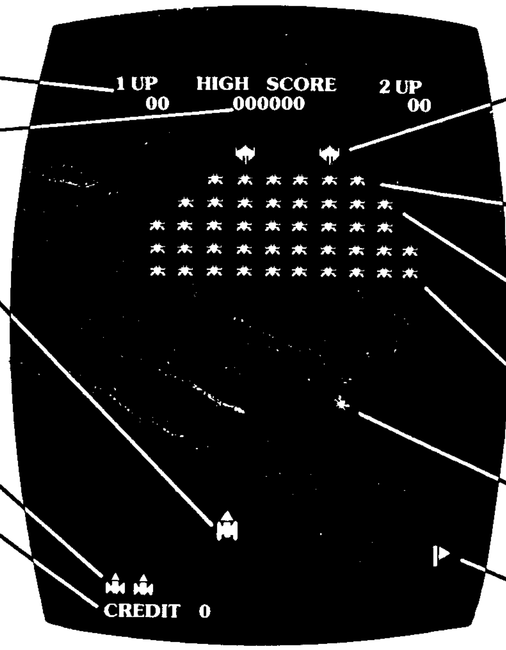
Score: 1 or 2 player. Maximum score: 999,990.

High Score: Retained and displayed up to 6 digits.

Defender Galax Ship: Moves freely across bottom of monitor firing missiles at aliens.

Reserve Galax Ships: Number of player-up remaining ships clearly indicated.

Credit Line: Maximum 9 credits per player.



ALIEN SHIPS' POINTS:

Flagship: 60 points each. 150, 200, 300 and 800 bonus points when hit while attacking.

Red Alien: 50 points each. 100 bonus points for hits while attacking.

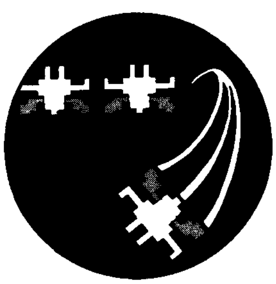
Purple Alien: 40 points each. 80 bonus points for hits when attacking.

Green Alien: 30 points each. 60 bonus points when attacking.

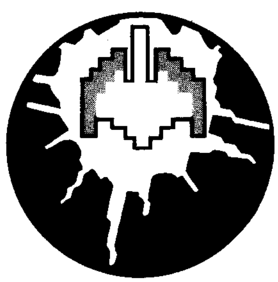
Alien Attacker Ships: Double score for each ship shot down.

Flag: One awarded for each convoy destroyed.

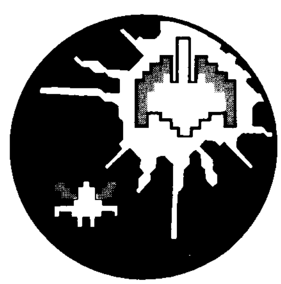
BONUS POINTS:



Double Points: For lone green alien attacking at random.



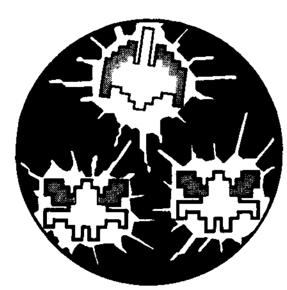
150 Points: For hitting lone attacking flagship.



200 Points: For hitting attacking flagship with single escort.



300 Points: For hitting attacking flagship with two escorts.



Special 800 Points: For destroying fighter escort and flagship. (Escort ships must be hit first.)

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10750 West Grand Avenue
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DISTRIBUTED BY:

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GALAXIAN

TROUBLE SHOOTING LOGIC BOARD PC A082-91352-B000

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1. CHECK +5VDC AT CPU AND ROMS.
2. 6MHZ CLOCK FREQUENCY AT PIN #5-E1 AND 3MHZ AT PIN #6 OF CPU.
3. RESET LINE PIN #26 OF CPU NORMALLY HIGH AND GOES LOW WITH RESET.
4. CHECK RAM AND ROM TEST FOR BAD RAM OR ROM. IF TV SHOWS A BAD ROM MAKE SURE PROGRAM CARD IS SEATED PROPERLY.
5. ROM TEST WILL NOT TEST THE CHARACTER ROMS AT L-1 & H-1 (REPLACE).
6. WHEN CHARACTER ROMS ARE REMOVED THE TV SCREEN WILL SHOW HORIZONTAL BARS.
7. REMOVE PROGRAM PC A082-91353-A866 AND TV SCREEN SHOULD HAVE GARBAGE WITH RESET LINE PULSING.
8. CHECK ALL ADDRESS AND DATA LINES COLOR ROM 6-L & 1-N.
9. CHECK ALL ADDRESS AND DATA LINES CPU (Z80).
10. CHECK ALL ADDRESS AND DATA LINES L-1 & H -1.
11. GAME WILL PLAY WITHOUT CHARACTER ROMS WITH LOSS OF VISUAL EFFECT.
12. PROCEED TO TROUBLE SHOOTING LOGIC BOARD PART II MANUAL.
13. GOOD LUCK

GALAXIAN

Trouble Shooting
PC A082-91352 Logic Board
[Total 122 Chips]

NOTE: All I.C. trouble shooting information is with the I.C. removed from circuit.

POSITION	CHIP	POSSIBLE TROUBLE
1-A	74LS164	No Stars - No Explosion - High pitch Missile sound.
2-A	74LS30	No Stars.
3-A	74LS161	Diagonal lines on screen - Effects Horizontal Count.
4-A	74LS161	Blank Screen - Effects Horizontal Count.
5-A	74LS161	Thin vertical lines on screen - Effects vertical count.
6-A	74LS161	Blank Screen - Effects vertical count.
11-A	LM377	No Sound.
1-B	74LS64	No Stars - No Explosion - High Pitch Missile sound.
2-B	74LS366	No Stars.
3-B	74LS86	Double Image - Distorted characters.
4-B	74LS86	Vertical rows of Flags & Invaders - The word credit appears up and down left side of screen.
5-B	74LS86	Letters & Numbers missing - Distorted Invaders & Ram Rom Test - Star OK.
6-B	74LS86	Blank screen Ram - Rom test distorted - Stars OK.
7&8-B	Z80A	Screen covered with Distorted Letters & Numbers.
9-B	74C245 74LS245 8304	Continuous Sound - Screen Total Garbage - Stars OK.
1-C	74LS74	Stars Move in wrong direction (up).
3-C	7420	No Explosion - High Pitch Missile Sound - All words wrong Sequence.
4-C	74LS139	All Diving objects are numbers. (21 & 30)
5-C	7474	Blank Screen - Effects Vertical & Horizontal Blanking.
6-C	7474	Large squares on screen (Eight) - High Pitch sound continuous.
9-C	74LS 368	Free Play - Effects Dip Switch.

GALAXIAN

Trouble Shooting
PC A082-91352 Logic Board.
(Continued)

POSITION	CHIP	POSSIBLE TROUBLE
1-D	74LS107	Blank Screen Effects Clock.
2-D	74LS74	No Stars - No Explosion - High pitch Missile sound.
3-D	74LS74	Flashing Letters - Numbers - No Stars.
4-D	74LS139	Blank Screen - Distorted Ram Rom Test - Stars OK.
5-D	74LS10	Blank Screen - Effects Vertical & Horizontal Blanking.
6-D	74LS02	Distorted video entire screen - Effects Clock.
7-D	74LS367	Letters - Numbers - Garbage entire screen - Effects Addresses.
8-D	74LS367	Letters - Numbers Garbage entire screen - High Pitch sound continuous.
9-D	74LS368	No control players Glaxship moves to left - No Shells - No Missile.
1-E	74LS368	Blank Screen - Effects Clock.
2-E	74LS157	Blank Screen - Effects Vertical Ram Address.
3-E	74LS157	Effects Rom & Ram Test - Test flashes over & over.
4-E	74LS157	Runs Rom & Ram test continuous.
5-E	7404	Runs Rom & Ram Test continuous.
6-E	74LS139	Blank Screen - Effects Horizontal & Vertical Count.
7-E	74LS367	Letters - Numbers & Garbage on Screen High Pitch Sound.
8-E	74LS139	Same as 7E
9-E	74LS368	Stays in Ram Rom Test.
2-F	74LS157	Screen flashes Letters - Numbers & Garbage.
3-F	2114(Ram)	Screen covered with dot pattern.
4-H&F	2101(Ram)	Bad Ram #3.
5-H&F	2101(Ram)	Bad Ram #3.
6-F	7474	High Pitch Tones - Horizontal lines on screen.
8-F	8216	Same as 9B.

GALAXIAN

Trouble Shooting
PC A082-91352 Logic Board
(Continued)

POSITION	CHIP	POSSIBLE TROUBLE
9-F	74LS368	Game starts with coin - will not select 2 player game - continuous tone in switch test.
1-H&J	2716(Prom)	Game plays - Color Horizontal Bars - Invaders all red - Diving objects square.
2-H	74LS194	Game Plays - Distorted characters Effect Character Prom.
3-H	2114(Ram)	All zeros on screen.
6-H	74LS08	Game Plays - Flips Picture - Distroted Invaders & Galaxip.
8-H	8216	Same as 9B.
2-J	74LS194	Game Plays - Effects Character Prom.
3-J	74LS157	Game Plays - Letters & Numbers(EC &A8) - Invaders all letters (EC) - Hi-Score Distorted - Effects addresses of Character Prom.
4-J	8216	Same as 5-J.
5-J	74LS245 74C245 8304	Letters and Numbers entire screen.
6-J	74LS157	Game Plays - Fast diving invaders - All words are backwards - Distorted invaders.
9-J	74273	Game Plays Effects Tone Generator - No Start, Dive, Coin tones Etc..
1-K&L	2716(Prom)	Same as 1-H&J with different colors.
2-K	74LS194	Game Plays - Horizontal lines across screen - Distorted invaders.
3-K	74LS157	Game Plays - Zeros & Letters on screen Diving Invaders Distorted.
4-K	8216	Same as 5-J.
5-K	74LS245 8304	Same as 5-J.
8-K	74LS161	Game Plays - Effects Tone Generator - No coin, start, dive Invader Hit Tones Etc..
9-K	74LS161	Same as 8-K.

GALAXIAN

Trouble Shooting
PC A082-91354 Logic Board.
(Continued)

POSITION	CHIP	POSSIBLE TROUBLE
2-L	74LS194	Game Plays - Effects Character Prom - Characters wrong place on screen - Vertical Roll.
3-L	74LS157	Game Plays - Effects Character Prom - Horizontal bars across screen.
4-L	74LS273	Game Plays - Diving objects distorted - Effects Horizontal Position.
5-L	74LS367	Stays in Ram - Rom Test - Garbage in test.
6-L	82S123(Color Rom)	Game Plays - No Invaders - No diving objects - No Letters & Numbers. Sound, Stars, Shells, Missile OK.
8-L	74LS00	Horizontal lines - Continuous Sound.
9-L	74LS259	Effects Tone Generator - No Explosion - Wrong Tones all other sounds - Back-ground sound in game over.
10-L	ULN2075B	Game Plays - 2 player game 2nd player fails to fire missile & move L&R. No Meter Pulse.
1-M	74LS86	Game Plays - Diving objects are Blocks, Invaders are Blocks - Letters & Numbers are Blocks Missile Shells and Stars are OK.
2-M	74LS273	Game Plays - No Invaders - Diving objects - Letters & Numbers. Missile - Shells - Stars, Audio OK.
3-M	74LS30	Game Plays - No Missile - No Shells.
4-M	74LS367	Defective Ram - Rom Test runs continuous.
5-M	74LS367	Same as 4-M.
6-M	74LS273	Game Plays - No Invaders - Letters - Numbers - Galaxips. Effects color Rom 6-L. Stars - Missile - Shells OK.
8-M	74LS138	Continuous Tone sound - Bit & Bytes cover entire screen.
9-M	74259	Game Plays - Effects Tone Generator - Alters Background Sound - No Meter Pulse.
1-N	27LS00(Ram)	Game Plays - Diving Objects Distorted - Colors Missing.
2-N	74LS08	Blank Screen - Effects Ram select 7-P & 7N.

GALAXIAN

Trouble Shooting
PC A082-91352 Logic Board.
(Continued)

POSITION	CHIP	POSSIBLE TROUBLE
3-N	74S20	Game Plays - 3 Rows of Invaders Missing(Dots) Numbers & Letters are yellow - No Diving Objects Effects Color 2.
4-N	74LS283	Defective Ram Rom Test - A row of Numbers at bottom of screen. (20) Invaders appear lower screen - Stars OK.
5-N	74LS283	Defective Ram Rom Test - Horizontal squares appear - Stars OK.
6-N	74LS02	Stars only - Stars move up screen -Effects color Rom 6-L.
7-N	2114(Ram)	Bad Rom #1.
8-N	74LS138	Bad Rom #1 - Effects Dip Switch & Controls.
9-N	74LS259	Defective Ram - Rom Test - Stars move jerky up screen.
1-P	27LS00(Ram)	Game Plays - Diving objects distorted with missing colors.
2-P	74LS00	Game Plays - Invaders all red - Letters & Numbers are are Red & Green Effects Video O & I.
3-P	74LS20	Game Plays - Top 3 rows of invaders are dots - Diving objects groups of 3 are distorted. Effects color O&I.
4-P	74S10	No Missile - No Shells - Game Plays.
5-P	74LS74	Game Plays - Missile Horizontal yellow line - Diving objects white Horizontal lines with Multiple dots.
6-P	74LS377	Game Plays - All letters & Numbers are upside down - No diving objects - Distorted invaders - Stars move slowly & are too many.
7-P	2114(Ram)	Bad Ram #1.
8-P	74LS138	Flashes Bad Ram #1 & Letters over entire screen.
1-R	27LS00(Ram)	Game Plays - Group of 3 diving objects wrong color.
2-R	74LS08	Defective Ram - Rom Test - Entire screen letters - Numbers & Garbage.
3-R	74LS02	Blank Screen - Effects the five 27LS00 Rams.
4-R	74161	Game Plays - No Missile.
5-R	74161	Same as 4-R.

GALAXIAN

Trouble Shooting
PC A082-91352 Logic Board.
(Continued)

POSITION	CHIP	POSSIBLE TROUBLE
6-R	74175	Game plays - Invaders - Diving Objects - Letters - Numbers wrong color.
7-R	CD4066	Game Plays - No Missile Sound - No Explosion Sound - Effects all Generator Tones. (High Pitch).
8-R	555	Game Plays - Effects background Sound.
9-R	555	Game Plays - Effects Background sound which is a steady tone.
1-S	27LS00(Ram)	Game Plays - Effects diving objects color.
2-S	74LS00	Game Plays - Diving Objects - Invaders Letters & Number wrong color.
3-S	74LS32	Game Plays - Diving Objects - Invaders change colors.
4-S	74S161	Game Plays - No Shells.
5-S	74S161	Game Plays - No Shells.
6-S	74S74	Garbage entire screen - No Colors Continuous Tone Sound.
7-S	555	Game Plays - No Missile Sound.
8-S	555	Game Plays - Effects Background Sound wrong pitch.
1-T	27LS00(Ram)	Game Plays - Diving Objects are white dots.
2-T	74LS86	Game Plays - Horizontal Lines on Invaders hit - Diving Objects Horizontal lines - Flashing Horizontal lines in Ram - Rom Test.
3-T	74LS86	Game Plays - 16 Horizontal lines across screen - Lines change in thickness when playing.
4-T	74LS163	Games Plays - Diving Object appears at top of screen - Explosion appears at top of screen.
5-T	74LS163	Game Plays - Same as 4-T.
6-T	74LS393	Defective Ram - Rom Test - Screen total garbage. Effects Watchdog.
7-T	LM324	Game Plays - No Explosion - No Missile Sound - Effects Background Sound.
8-T	555	Game Plays- Effects Background Sound.
1-U	74LS174	Game Plays - Diving Objects Missing.

GALAXIAN

Trouble Shooting
PC A082-91352 Logic Board.
(Continued)

ADDITIONAL DEVICES

POSITION	
1-F	Crystal (18,432).
1R-1	+5VDC Regulator 78GV.IC
1R-2	Pass Transistor D44VM4 (Tip 31)
7-K & 7-L	Memory Board PC - 082 - 91353 - A866
Note:	Loose or Missing Memory Board Screen will be total Garbage.
	The 74LS42 Decoder IC on Memory Board is Rom Select.

NOTES

THIS SPACE IS PROVIDED FOR PERSONAL NOTES

GALAXIAN LOGIC BOARD

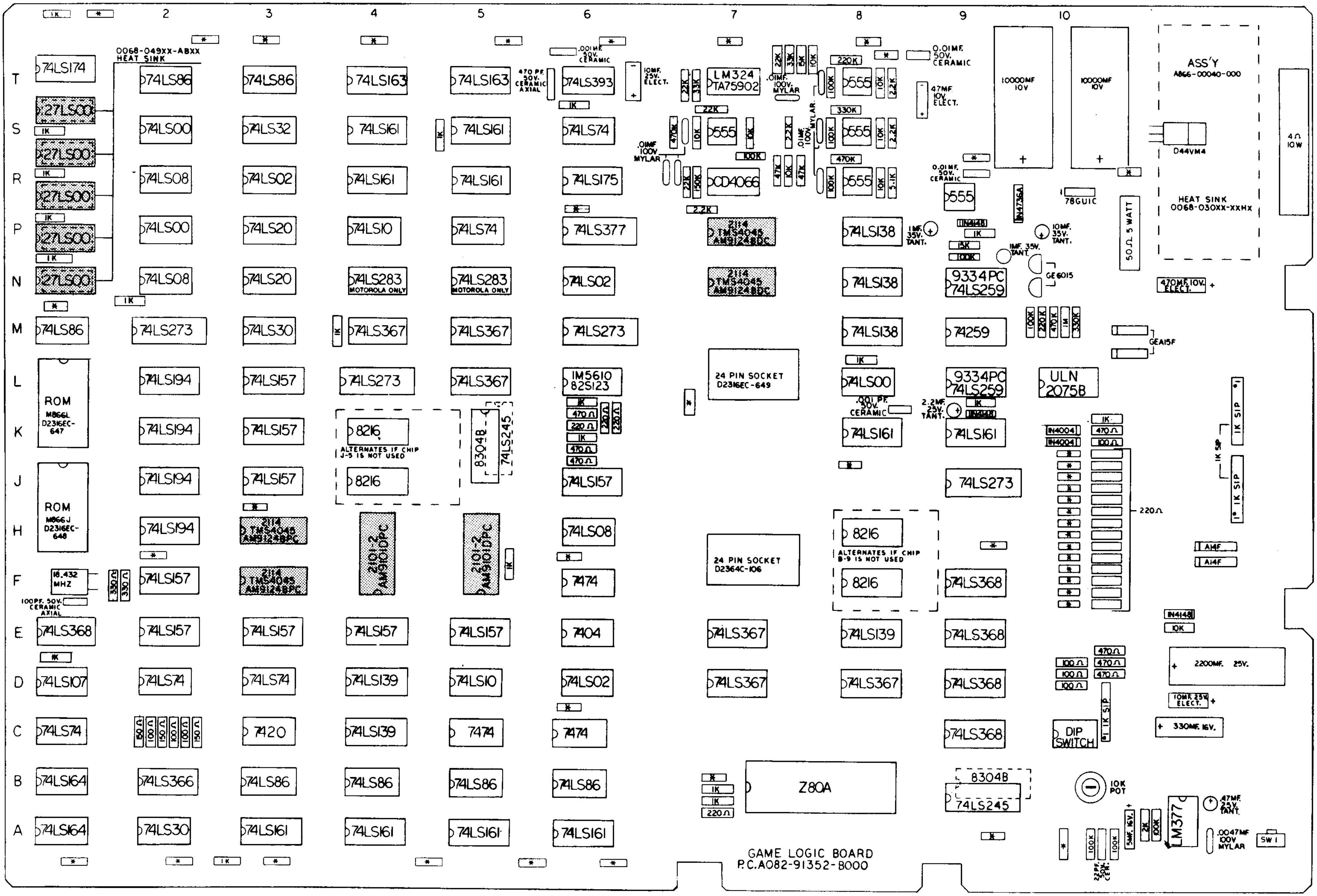
CHIP NUMBER	FUNCTION
74LS00	Quad Two Input Nand
74LS02	Quad Two Input Nor
7404	Hex Inverter
74LS08	Quad Two Input And
74LS10	Triple Three Input Nand
74LS20	Dual Four Input Nand
74LS30	Eight Input Nand
74LS32	Quad Two Input Or
74LS74	Dual"D" Flip-Flop
74LS86	Quad Two Input Exclusive Or
74Ls107	Dual "JK" Flip-Flop
75LS138	Three to Eight Line Decoder
74LS139	Dual Two to Four Line Decoder
74LS157	Quad Two Input Multiplexer
74LS161	Four Bit Counter
74LS163	Four Bit Counter
74LS164	Eight Bit Shift Register
74LS174	Hex"D"Flip-Flop
74LS175	Quad "D" Flip-Flop
74LS194	Eight Bit Shift Register
74LS259	Eight Bit Addressable Latch
74LS273	Octal "D" Flip-Flop
74LS283	Four Bit Binary Adder
74LS245	Octal Bus Transceiver
74LS366	Hex Bus Driver-Inverting
74LS367	Hex Bus Driver
74LS368	Hex Bus Driver - Inverting
74LS377	Octal "D"Flip-Flop

GALAXIAN LOGIC BOARD

CHIP NUMBER	FUNCTION
74LS393	Dual Four Bit Binary Counter
27LS00	Ram
2114	Ram
TMS4045	Ram
AM9124	Ram
2101-2	Ram
AM9101	Ram
8304	Bus Driver - Bidirectional
8216	Bus Driver - Bidirectional
LM324	Quad Operational Amp
555	Timer
LM377-1877	Audio Amp
Z80	CPU
2716	Prom - 16K
1M5610	Prom
78GUIC	Voltage Regulator
ULN2075	Quad Buffer
18.432	X-TAL
CD4066	Quad Electronic Switch
D44VM4	Transistor
GE6015	Transistor
MC14066	Quad Electronic Switch
GEA15F	Diode - Rectifier
A14F	Diode - Rectifier
IN4148	Diode - Rectifier
IN4736A	Diode - Zener
D2316EC 2716 & 9316	16K Rom - Prom
D2364C	64K Rom

COMPONENT LAYOUT PART NO. M051-00866-B002

* INDICATES 0.1MF, 50V, AXIAL LEAD CERAMIC CAP



NOTE: ALL RAMS SHADED

NOTES

THIS SPACE IS PROVIDED FOR PERSONAL NOTES

NOTES:

1. 8 PULL-UP RESISTORS AND 26 DECOUPLING CAPACITORS ARE DISTRIBUTED OVER THE P.C. BOARD ASS'Y.
2. ONLY 1 PC 74LS245, OR 1 PC 8304B, OR 2 PC 8216 ARE USED (AND STUFFED) FOR BI-DIRECTIONAL DRIVERS (1 BYTE OF DATA).
3. SAME AS NOTE 2.
4. SUBSTITUTION FOR THESE ROM'S IS MEMORY BRD. ASS'Y A084-91353-A866

INDICATES +5V

REV.	DESC.	DATE
B	ALL 0.1MF CER. CAP. → AX. LEAD	1-20-80

MIDWAY MFG. CO.
FRANKLIN PARK, ILL.

DRN. G. RIZZO	CKD.
DATE JAN. 1980	NO. REQ'D 1
USED ON GALAXIAN	
DESC. LOGIC BOARD CIRCUITRY	
PART NO. A082-91352-A/B000	

LOGIC SCHEMATIC PART NO. M051-00866-A015

